

KANSAS NITRATE STRATEGY  
KDHE  
BUREAU OF WATER  
PUBLIC WATER SUPPLY

**SUBJECT:**

Nitrates in drinking water.

**PURPOSE:**

The purpose of this strategy statement is to establish the procedure used by the Bureau of Water in responding to community public water supplies whose nitrate-nitrogen level exceeds the maximum contaminant level of 10 mg/l.

**BACKGROUND:**

Nitrate has long been the most persistent compliance problem facing Kansas water suppliers relying on groundwater for their source of supply. Historically, communities faced with significant nitrate levels in one or more wells, were able to drill another well in an area where nitrate levels were acceptable. This option is now frequently unavailable as more areas are closed to further appropriations and it is increasingly difficult to locate groundwater with acceptable nitrate levels.

Regulations are now stricter, requiring monitoring of each individual entry point to the distribution system instead of collecting random samples from the distribution system. Since each well is often its own entry point, this change in monitoring requirements has resulted in more frequent detection of wells exceeding the drinking standard for nitrate.

The drinking water standard, or maximum contaminant level (MCL), for nitrate in drinking water is 10 mg/l, measured as nitrogen. Nitrate concentrations in drinking water can also be measured as nitrate. The MCL for nitrate in drinking water is 45 mg/l when measured or expressed as nitrate. In this document, nitrate concentrations will be expressed as nitrogen.

The health effect associated with nitrate in drinking water is methemoglobinemia.

Methemoglobinemia is often referred to as infant cyanosis or "blue baby disease" as the skin can take on a bluish tint with higher levels of methemoglobin in the bloodstream. Nitrate must be chemically reduced, or converted to nitrite by bacteria in the mouth or digestive system to cause methemoglobinemia. Nitrite converts hemoglobin to methemoglobin, which cannot transport oxygen through the bloodstream. After the age of six months, stomach acidity is generally sufficient to prevent growth of the bacteria which convert nitrate to nitrite. In infants less than six months however, low levels of gastric acidity may favor growth of nitrate reducing bacteria. Infants with gastrointestinal illness are even more vulnerable to nitrite formation. Thus, infants less than six months of age are the population group vulnerable to methemoglobinemia. Adults and children over the age of six months are not vulnerable to methemoglobinemia at nitrate levels commonly found in drinking water.

The Environmental Protection Agency also considered nitrate's carcinogenic potential when establishing the MCL, and stated it was not convinced nitrate in drinking water presented a potential risk of cancer. EPA also stated data concerning the potential carcinogenicity of nitrate could not be dismissed, and continues to study this issue. The National Academy of Sciences concluded nitrate in drinking water is unlikely to contribute to cancer risk.

The EPA also establishes unreasonable risk to health or URTH values as part of its health effects review when establishing maximum contaminant levels. The official use of URTH values is in issuance of variances and exemptions from MCL's. URTH values are also useful in determining potential health effects from exposure to water exceeding the MCL's. The nitrate URTH level for infants less than 6 months of age is 10 mg/l nitrate-nitrogen. For all others, the URTH level is 20 mg/l nitrate-nitrogen.

Methemoglobinemia is primarily associated with private drinking water wells and is rarely noted at nitrate levels less than 20 mg/l as nitrate-nitrogen. The few wells with nitrates less than 20 mg/l causing methemoglobinemia were bacteriologically contaminated. Bacteriological contamination causes diarrhea, which makes infants much more susceptible to lower nitrate levels. Private wells are more likely than public water supply wells to be improperly constructed and located near sources of organic materials. Public water supply wells are usually drilled and cased, and are located away from sources of bacterial contamination. In addition, disinfection is mandatory for Kansas water supply wells.

Since the health effects of nitrate concentrations of less than 20 mg/l in drinking water are limited to infants less than six months of age, the risk to public health can be managed by the provision of an alternate source of drinking water meeting the nitrate MCL, to those impacted. This unique feature of nitrate health effects allows KDHE to use a different approach in responding to community public water supplies experiencing compliance problems with nitrates.

KDHE will review this strategy and make revisions necessary to protect public health, if new information becomes available indicating different health effects than are currently known.

#### **APPLICABILITY:**

The Bureau of Water will apply this strategy to community public water supplies. Non-community supplies (both transient and non-transient) are allowed nitrate levels up to 20 mg/l as nitrogen, subject to certain posting and public education requirements.

**STRATEGY:**

When nitrate results for any given quarter exceed 10 mg/l, the public water supplier will be required to give public notice as required by Kansas administrative regulations for an acute MCL violation. The public notice will include a recommendation to seek an alternate source of water for infants under six months of age, mothers nursing infants under six months of age, and pregnant women. The public water supplier will also be required to continue quarterly monitoring as required by regulation.

The Bureau of Water will take the following additional actions when any two of three consecutive quarterly samples exceed the maximum contaminant level (MCL) of 10 mg/l. Systems with nitrate levels exceeding 10 mg/l at a lesser frequency may request inclusion in this control strategy also.

1. MONITORING. At KDHE's discretion, the monitoring frequency may be increased to monthly to establish a clear trend in nitrate levels. If the public water supply system has multiple points of entry, monthly monitoring will only be required for those points exceeding the MCL. When a point of entry represents multiple wells, monitoring of individual wells may be required to define the source and extent of the nitrate problem.
2. PUBLIC NOTIFICATION. Copies of the public notice required by regulation, and the ATSDR information on nitrate/nitrite toxicity contained in Appendix D, will be provided to all local health care providers, including medical doctors, clinics, hospitals, and the appropriate local county health department. Copies of the public notice information shall also be provided to day care providers and commercial establishments serving the traveling public, such as restaurants and roadside parks. In addition to the mandatory public notification language required by regulation, the public notice shall provide information concerning the alternative water program described by paragraph 3 below. When nitrate levels fluctuate, public notification will only be required when monitoring indicates nitrate levels over the MCL.
3. ALTERNATIVE SOURCE OF WATER. The public water supplier shall be required to provide free of charge, an alternative source of drinking water for all infants less than six months of age, mothers nursing infants less than six months of age, and pregnant women. The public water supplier will be required to present a proposal to KDHE for approval, indicating how water will be supplied. The drinking water provided must meet the requirements of K.A.R. 28-15-13. If

bottled water is chosen to meet this requirement, the public water supplier shall obtain a certification from the bottled water supplier that the bottled water meets the appropriate requirements of the FDA concerning the source of the water and monitoring of water quality. When nitrate levels fluctuate, provision of an alternative source of water will only be required when monitoring indicates nitrate levels over the MCL.

4. **CORRECTIVE ACTIONS.** Depending on the level of nitrates in the drinking water, the public water supplier will be required to implement corrective actions as follows.
  - A. **NITRATE BETWEEN 10 AND 15.** If nitrate levels exceed 10 in any two of three consecutive quarterly samples, KDHE and the public water supplier will jointly review the feasibility of the following options:
    - i. obtaining a new source of water,
    - ii. blending existing sources of water to produce acceptable quality water,
    - iii. purchase of water of acceptable quality from another public water supply,
    - iv. interconnection with a neighboring public water supplier,
    - v. minimizing the use of, or removing from service, the individual sources causing the problem,
    - vi. participating in the wellhead protection program to locate the nitrate source and reduce the levels of nitrate in the groundwater, and
    - vii. funding through the Community Development Block Grant program, the Rural Economic Development agency, or the forthcoming public water supply loan program.
  - B. **NITRATE OVER 15.** If nitrate levels exceed 15 mg/l in any two of three consecutive quarterly samples, the public water supplier will be required to obtain the services of a professional engineer to prepare a formal feasibility study, including cost estimates, of options 4.A.i through 4.A.iv in the above paragraph, and treatment of the source water to reduce levels of nitrate to acceptable level.
  - C. **NITRATE OVER 20.** If nitrate levels exceed 20 mg/l in any two of three consecutive quarterly samples, the public water supplier will be required to implement the most feasible option identified in the above paragraph.

## **IMPLEMENTATION**

This strategy will be implemented with an administrative consent order or an administrative order under the authority of KSA 1996 Supp. 65-163. Appropriate time frames for completion of the activities will be negotiated with the public water supplier. The consent order will terminate automatically if monitoring indicates nitrate levels are less than the MCL in four consecutive quarters.

Additionally, the order will expire seven years after issuance, if the public water supplier has not returned to compliance. KDHE and EPA will jointly review on a case-by-case basis whether any public water suppliers that have not returned to compliance at the end of seven years should be given an extension of the administrative order. EPA and KDHE must both agree before any extension is granted. The following factors will be reviewed to determine if any extension should be granted: the current nitrate levels and whether the trend is increasing or decreasing; the amount of usage from any point or points of entry exceeding the nitrate MCL; efforts of the public water supplier to participate in a wellhead protection program; and the availability of funding through the Kansas public water supply revolving loan program, or other sources.

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## **APPENDICES**

- A     Public Notice regulation
- B     Sample public notice for nitrate
- C     Suggested posting information for businesses serving transients
- D     Methemoglobinemia symptoms and treatment information

## APPENDIX A

### PUBLIC NOTICE REGULATION

KAR 28-15-15a

## APPENDIX B

### SAMPLE PUBLIC NOTIFICATION FOR NITRATE



## APPENDIX C

### SUGGESTED POSTING FOR BUSINESSES

#### SERVING THE TRAVELING PUBLIC

## ATTENTION!

The drinking water provided to this facility by the \_\_\_\_\_ public water supply system may contain more nitrate than is considered safe for infants less than six months of age. Water from this facility should not be used to prepare infant formula, reconstitute juice, or given to these individuals. Boiling the water will increase the level of nitrate, not reduce it. Parents or guardians of infants should use an alternate source of water, such as bottled water for this purpose.

Excessive levels of nitrate in drinking water can cause methemoglobinemia in infants less than six months of age. Methemoglobinemia, also known as blue-baby disease, occurs when nitrates interfere with the ability of the body's hemoglobin to carry oxygen through the bloodstream. Infants with diarrhea are more vulnerable to methemoglobinemia than healthy infants.

## APPENDIX D

METHEMOGLOBINEMIA SYMPTOMS

AND

TREATMENT INFORMATION